

METHOD FOR OFFLINE-PARAMETERING OF A FIELD DEVICE  
OF THE PROCESS AUTOMATION TECHNOLOGY

[01] The invention relates to a method for offline-parametering of a field device of the process automation technology in accordance with the preamble of claim 1.

[02] In the process automation technology, field devices are frequently utilized that serve for registering and/or influencing process variables. Examples of such field devices are fill level measurement devices, mass flow meters, pressure gages, thermometers, etc., which, as sensors, register the corresponding process variables fill level, mass flow rate, pressure and temperature, respectively, and so-called actors, which e.g., as valves, control the flow rate of a liquid in a section of pipe or pumps in the fill level of a medium in a container.

[03] Field devices are often connected over appropriate communication connections, as a rule over a field bus, with a control unit (e.g. programmable logic controller PLC), which controls the process flow. In this control unit, the measurements of the various sensors are evaluated and the appropriate actors actuated.

[04] Usually, the field bus is connected, as well, with a higher level communications network, which serves for data communication with a control system (Siemens Simatic S7, Fisher-Rosemount Delta V, ABB Symphony) and perhaps also with business systems (e.g. SAP R/3).

[05] In the control system, the process flow is monitored and visualized. The control system also enables a direct access for operating, parametering or configuring individual field devices. Through this access, special settings (e.g. parameters) can be changed in the field devices, or diagnostic functions can be called

up.

[06] Along with the access through the control system, a temporary access on site is also possible e.g. using an operating device, such as a portable personal computer (laptop) or a portable, manual operating device (handheld). The operating programs installed in the operating devices or control systems are also referenced as operating tools.

[07] In the past, each field device manufacturer developed corresponding operating tools for operating its field devices. This led to a multiplicity of different operating tools on the market. Since modern operating tools must not only enable the operating of their own field devices but also those of other manufacturers, the functionality of the field device to be operated must be made known to the currently connected operating tool. The functionality of a field device is normally described by means of a device description. For this purpose, special, standardized device description languages are available. Examples are CAN-EDS (Control Area Network-Electronic Data Shield), HART-DDL (HART Device Descriptions Language), FF-DDL (Fieldbus Foundation-Device Descriptions Language, Profibus-GSD), Profibus-GSD, Profibus-EDD (Profibus-Electronic Device Descriptions).

[08] Data transfer between the field devices and the control systems proceeds by way of the known international standards for field busses, such as e.g. HART®, Foundation Fieldbus FF, Profibus, CAN, etc.

[09] As already mentioned, the parameters of the individual field devices can be modified using a corresponding operating program. Examples for such parameters are measurement range, limit values, units, etc.

[010] As a rule, the field device that is to be operated is

connected physically by way of a data bus with the computer system (operating device, control system) in which the operating program is installed. During operation, communication is possible between operating program and field device. This is referred to as online-operating. The parameters are read out of the field device and, directly after the modification, transferred to the field device and stored therein. In this connection, the dependencies among parameters are immediately taken into consideration. A change of a parameter can lead to the change of further parameters or change the observability of a parameter or change the valid range of a parameter. An example for this: If the parameter "Total Reset" is set to "yes", then the action "Set parameter TotSum to 0" is initiated in the field device. The corresponding data description for the online-operation reads: After the writing of TotReset, read out the parameter TotSum. The device responds by setting TotSum to 0 and outputs the desired value.

[011] Besides the online-operation, an offline-operation is also desired, i.e. when, during the operation procedure, no communication with the field device can occur; for instance, the corresponding field device is not connected with the data bus at the point in time of the operation or it is momentarily executing important process functions that are not to be interrupted. Such offline-parametering is e.g. possible with the operating program CommunWin® of the firm Endress + Hauser.

[012] In order to enable an offline parametering of a particular field device, it is necessary, either to expand an already existing device description for this field device, which describes the offline behavior of this field device, or to produce a new device description, which includes the offline behavior of this field device. For simple field devices, this is immediately possible. For field devices, which possess a comprehensive functionality, and, therefore, exhibit a multitude of parameters with corresponding dependencies, this is, however, not possible

without a considerable programming expense. Especially value assignments of variables and calculations are very difficult to describe. Frequently it is not even possible to describe the offline behavior of a complex field device completely with one of the known device description languages. Because of the high programming expense, an offline parametering is e.g. currently not possible in the case of field devices of the PNG-series of Endress+Hauser®.

[013] Object of the invention is, therefore, to provide a method for offline-parametering of a field device of the process automation technology. The method should require no great programming expense and be simple and cost favorable to carry out.

[014] The object of the invention is solved by the method defined in claim 1. The essential idea of the invention resides therein, that, for offline-parametering, the operating program communicates not with the device software program, which runs on a microprocessor in the field device, but, instead, with a copy of the device software program running on a separate computer unit. Consequently, a device description, which describes the special offline-behavior of the field device, is not necessary, since the operating program sees, in effect, an online field device.

[015] In a further development of the invention, operating program and the copy of the device software program are installed on one computer unit. Thus, both programs can be executed together e.g. on a laptop, without the user noticing this while executing the operating program.

[016] Advantageously, the operating program and the copy of the device software program are joined with one another over a virtual interface COM-interface.

[017] Advantageously, the operating device has a Windows®-

platform. For this purpose, an easy-to-program Windows®-shell is required for the device software program.

[018] The invention is explained below in more detail on the basis of an example of an embodiment illustrated in the drawing, whose figures show:

[019] Fig. 1 block diagram of a process automation technology installation;

[020] Fig. 2 schematic structure of a field device; and

[021] Fig. 3 data bus with several field devices.

[022] The process automation installation illustrated in Fig. 1 shows a programmable logic controller PLC, which is connected over a data bus D with a plurality of field devices F1, F2, F3, etc. The field devices F1, F2, F3 can be e.g. pressure gauges, thermometers, flow meters, etc. The field devices F1, F2, F3 are "intelligent" field devices with corresponding microprocessors, in which the associated device software programs run for determining the functionality of the field devices.

[023] The control PLC communicates over the data bus D with each field device. In this way, data can be transferred between the field devices F1, F2, F3 and the control PLC.

[024] Data communication proceeds on the data bus according to the corresponding international standards, such as CAN, Profibus, HART® or FF. Connected to the data bus D is an operating device B, in which the operating program (e.g. FieldTool® of the firm Endress+Hauser) is installed. The data bus D, which represents the so-called field bus, is connected over a gateway G with a higher level, firm network N. Connected to the firm network N are various control systems L1 (SCADA), L2 (visualization) and L3

(engineering). The higher level, firm network N includes also a network connection to business systems, such as e.g. SAP R/3.

[025] Fig. 2 shows in more detail the construction of the operating device B. In the present example, operating device B is a personal computer PC (laptop), which exhibits essentially two external COM-ports COM1 and COM2 and a PC-card slot PCMCIA e.g. for a Profibus® interface card. The further, usual external components of a PC, such as keyboard, screen, etc. are not shown.

[026] The operating device can be connected with the various data busses over the COM-ports or the interface card, as the case may be. In this example, the COM1-port, COM1, is connected with a HART®-bus H through a HART®-modem HM.

[027] In the personal computer PC are installed an operating program B and a device software program GS, which both e.g. can operate in the Windows® operating system. The operating program B is connected with a memory S1, which provides the device descriptions for different field devices and a memory S2 for the storage of parameter values. It has a virtual interface COM8, which is connected with a virtual interface COM9 of the device software program. The device software program GS is a copy of the software running in the field device. This software is referred to also as "embedded software". In order that this software can run in the Windows operating system, the device software program GS is surrounded by a windows shell WH.

[028] Fig. 3 shows a data bus D, on which are connected the two field devices F1, F2, a process control system PLS, a service computer SR, and a server computer S. Framework application on each of the computers PLS, SR and S is the operating program FieldCare® of the firm Endress+Hauser. This program works on the FDT/DTM standard. The FDT specifications are available as Profibus-Guidelines Order No.: 2.162 in the Version 1.2.

The device drivers F1-DTM, F2-DTM and a COM-DTM are available in the process control system PLS and in the service computer SR as device descriptions. The device driver F1-DTM belongs to the field device F1 and the device driver F2-DTM to the field device F2. The COM-DTM is responsible for communication with the data bus D. Available on the server S are a COM DTM and a virtual device driver VF-DTM, for a certain field device F3. This means that two online field devices F1 and F2 are connected with the data bus D. The field device F3 is not physically connected with the data bus D, it is simulated by the virtual device driver VF-DTM. Additionally, the server computer S is connected over an Internet connection with the device manufacturer E+H of the field device F3.

[029]        The method of the invention for offline parametering is explained in more detail using the example of field device F1 as follows. On a user interface of the operating program running on the operating device, the user chooses the field device F1 to be operated and the operating mode offline parametering. In the choice online mode, a direct communication over the corresponding interface COM1, COM2 or the interface card would be possible with the device software program GS, which is executed on the microprocessor of the field device F1.

[030]        The operating program B communicates in the offline mode over the COM8 and COM9 interface with a copy of the device software program GS and sees thus, in effect, the field device F1, as if it were online. The original of the device software program GS runs normally on a microprocessor in the field device F1. The user can now effect the parameter changes in usual manner. The parameter changes are stored in the memory S2, taking into consideration the dependencies, and, as soon as a communication with the field device F1 is again possible over the field bus, following a confirmation by the user (changed parameter download yes/no), transferred to the field device F1 and stored therein.

[031] Since the device software program GS also has a COM1 interface, the operating program B and the device software program GS could also run on two separated computer units connected over a null modem cable.

[032] For the case that the field device 1 is not yet known to the operating program, the user selects manufacturer and type of field device F1 from a menu, so that the corresponding device description can be loaded from the memory S1 or, alternatively, e.g. from diskette. The method of the invention is, therefore, so cost favorable, because the device software (embedded software) is developed and tested on a PC independently of the offline parametering, and, consequently, the corresponding programs are available anyway.

[033] Conceivable also is not to surround the device software program GS with a Windows shell, but rather with a DTM shell, under the FDT/DTM standard. Device software GS and FDT-shell form together a virtual field device DTM, which is referenced in the following as VF-DTM. Such a virtual device driver VF-DTM can be bundled in simple manner in FDT frame applications, such as e.g. FieldCare® of the firm Endress+Hauser. Together with a normal device DTM, which has no offline functionality, such an associated field device can be operated completely offline. For offline parametering, the devices DTM then communicates not with the real field device, but, rather, with the virtual device driver VF-DTM.

[034] Over a corresponding communications-DTM, COM-DTM, one can, with a virtual device driver VF-DTM, in effect, simulate a field device VF on the data bus D. Thus, an installation with a plurality of real field devices and one or more virtual field devices can e.g. be completely parametered in the framework of the planning phase. Along with this, also measurement location designations, TAG-numbers and bus addresses for field devices not yet connected to the bus can be assigned. The operating program B



communicates with the field devices not yet connected to the data bus simply by way of the corresponding virtual device driver VF-DTM's.

[035] In a special, further development of the invention, these pieces of information (TAG-numbers and bus addresses) are directly transmitted to the field device manufacturer, in order to pre-configure the field devices there already during the manufacturing process. The user can connect the field devices to the data bus D immediately after their delivery.

[036] The essential idea of the invention lies in that, for offline parametering of a field device, the corresponding operating program B communicates with a copy of the device software program GS, which runs on a computer unit independent of the field device.[037]